Val. 21 (10)

# agricultural research

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# agricultural research

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## For Every Pot

Some 400 years ago, the good-hearted Henry IV sounded the call for "a chicken in every pot." Ironically, as a political slogan, the French monarch's benevolent wish to improve the welfare of his peasants echoes an incongruous note to anyone born since 1935. Yet only a generation ago, a chicken dinner on just any day of the week signaled a feast. Today, of course, drive-ins dot the highways and extol fried chicken; quick-frozen chicken pies and TV dinners sell by the millions; and whole and cut-up chickens are on display at every supermarket. Cooks and diners alike hold chicken in affectionate regard.

It was agricultural science that transformed yesterday's barnyard flock into today's gigantic agricultural industry. The ubiquitous broiler is a triumph that stems from cumulative advances, not from any single discovery or achievement. Of all the research advances, the main impact came from those in genetics and nutrition. Genetics enabled breeders to design a meatier and quicker-growing broiler; nutrition supplied the high-energy rations needed to sustain fast and efficient growth. The result: a broiler that takes 8 to 9 weeks to grow, and requires little more than 2 pounds of feed per pound of gain. This superb feed conversion rate—beef cattle and swine require about 8 and 3½ pounds of feed, respectively—looms significant as some experts speculate that more of the world's animal feeds will be diverted to people.

At six ARS laboratories, scientists of varied disciplines conduct research in support of the broiler industry. A major achievement of their research on diseases, for example, is a vaccine that protects broilers against the dreaded Marek's disease. A parallel effort is underway to develop a vaccine against an exotic strain of Newcastle disease which, fortunately, has so far been restricted to the egg industry. In other research, ARS scientists are studying the effects of nutrition and management on the efficiency of broiler production—basically, how to turn feed into meat.

Looking ahead, ARS scientists are seeking new feed ingredients that can economically produce broilers of good flavor. And, as labor costs mount, they are trying to devise ways of raising broilers in cages—from chick to market—thereby virtually eliminating the excessive handling inherent in the present system. The broiler industry is complex and dynamic. Like other modern industries, it relies on research for progress.





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**COVER:** These weevils have been irradiated from a Cobalt-60 source, a treatment that breaks the reproductive cycle (0173W80–18). See story on p. 3.

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**U.S. Department of Agriculture**

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# Sterilizing insects saves the grain

Insects damage and contaminate millions of bushels of stored grain at an annual cost to the U.S. economy of $1.2 billion. ARS scientists have successfully tested a practical method of using gamma rays to save some of this grain.

Gamma rays are emitted from a radioactive source, in this case Cobalt-60. The rays are highly penetrating and pass right through grain, leaving no contamination. Depending on the dosage and duration of exposure, however, the rays can kill living tissue. These characteristics allow a radiation treatment to kill insects but leave the grain itself unaffected.

The problem is that the radioactive treatment is not competitive in cost with presently used chemical treatments. To remedy this problem, ARS entomologists John H. Brower and Elvin W. Tilton tested the idea that a sublethal dose of radiation would sterilize the insects, thus interrupting their reproductive cycle. This would reduce infestation and eliminate further damage to grain.

The scientists also wanted to test a criticism of the radiation technique:

*Dr. Brower places weevil-infested wheat sample in irradiator. Platform inside chamber lowers the sample to the Cobalt-60 source (0173W82–25).*

***Right:*** *Wheat infested with rice weevils. A pencil point indicates size of this tiny but destructive pest (0173W82–4).*

that even though the insects were rendered sterile, they would still feed on the grain until they died.

The work was done at ARS' Stored-Product Insects Research and Development Laboratory, Savannah, Ga.

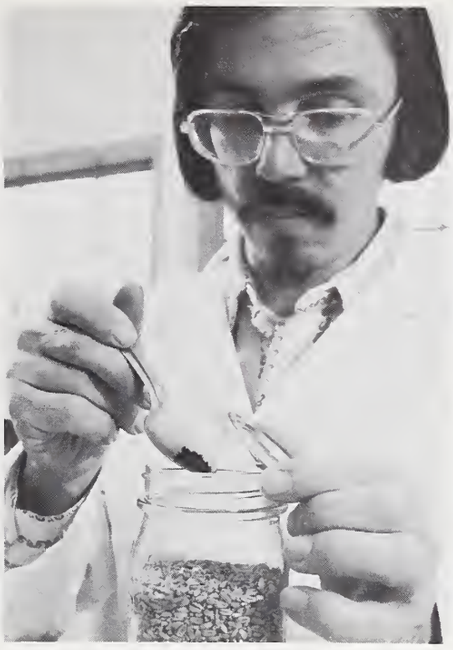
Two species of insects were tested for postirradiation feeding activity: the rice weevil, which is radiation sensitive; and the lesser grain borer, relatively more resistant to radiation.

Insects of each species were counted into groups of 100, and treated in a Cobalt-60 gamma irradiator at 0-, 2.5-, 5-, 10-, and 50-kilorad doses. Insects were placed in vials with wheat.

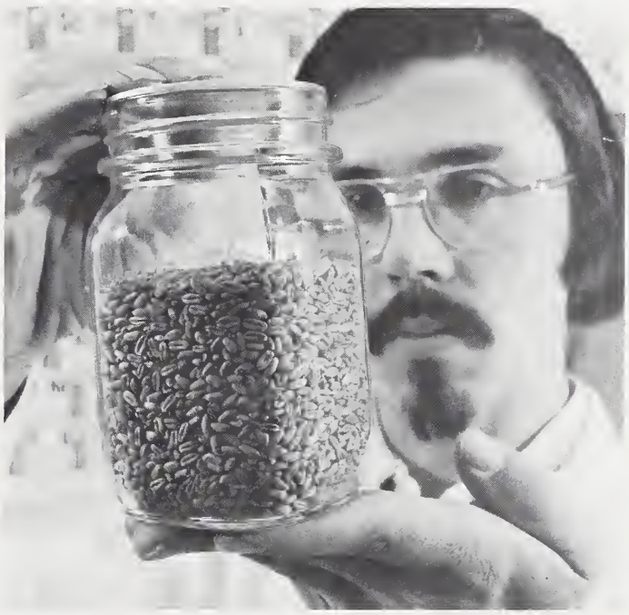
Weight loss—evidence of insect feeding—in the 2.5-kilorad groups increased very little between 1 and 4 weeks, but more rapidly thereafter. However, after treatment with 25 and 50 kilorads, very little weight loss occurred.

As expected, lesser grain borer adults proved more resistant to gamma radiation than did rice weevil adults. Dosage of 25 kilorads reduced feeding by the rice weevil to less than 3 percent and by the lesser grain borer to less than 11 percent.

Irradiated insects consumed less than untreated insects and, on the average, died much sooner at the higher radiation dosages. The number of larvae was also greatly reduced because reproduction was decreased or prevented.



***Left:*** *Dr. Brower places weevils in wheat sample prior to exposure to Cobalt-60 (0173W81–6).*
***Below:*** *This wheat sample is exposed to 100 weevils which is comparable to a very heavy investation in a grain bin (0173W81–7).*



Results indicate that the presence of live but sterile insects in irradiated bulk grain does not appear to pose the threat of grain damage suggested by some critics of the irradiation method.

In only 5 weeks, reduction in feeding damage in the 25-kilorad groups was 90 percent by the lesser grain borer and 97 percent for the rice weevil. Even less damage occurred after the insects were treated with 50-kilorads.

Unless reinfestation occurred, the scientists found that the small weight loss in the irradiated grain would remain the same. In unirradiated grain, however, weight loss would greatly increase as larvae matured, emerged, fed, and, in turn, reproduced. □

*The weevils in this petri dish have not been exposed to Cobalt-60. The physical characteristics of the weevils do not change after exposure (0173W80–20).*

# Introducing Cascade hops

A VERITABLE BONANZA of new business is envisioned by U.S. hop growers with the successful introduction of Cascade called, "probably the most significant development ever in the U.S. hop industry."

Introduced by ARS early in 1972 after years of development, Cascade is being accepted by some of the country's major breweries with the fourth largest contracting for some $30 million worth over the next 10 years. Other breweries—including the world's largest—are eyeing Cascade and are buying small but significant quantities, enough for extensive market testing.

The brewing industry employs hops for flavoring and bittering malt beverages—beers and ales. Before the days of pasteurization, and when brew recipes called for only barley, water, and hops, hops were also used for their antibiotic properties.

Cascade is the first hop variety developed in the United States with aroma and brewing characteristics similar to the milder varieties now coming from Europe. Its greatest market potential lies in replacing those imports.

Some of the country's largest breweries use mostly imported varieties which do not grow and produce well here. Since 1965, imports of hops into this country have increased from 6½ million pounds to more than 13 million pounds in 1971. That averages about $13 million annually.

From 351 acres in 1972, Cascade is expected to be planted on at least 5,000 acres by 1980 to supply the major contract alone. Only time will tell the acreage needs for future contracts. Total U.S. hop acreage is some 30,000 acres. The United States produces about 50 million pounds of hops annually; world production slightly exceeds 200 million pounds. West Germany, the world's largest producer, grows about 60 million pounds.

Hop culture is highly specialized and requires efficient farming and high yields. Processing and utilization have become more sophisticated over the last decade. Thus, any new variety must meet several standards to compete with imports or with accepted domestic crops.

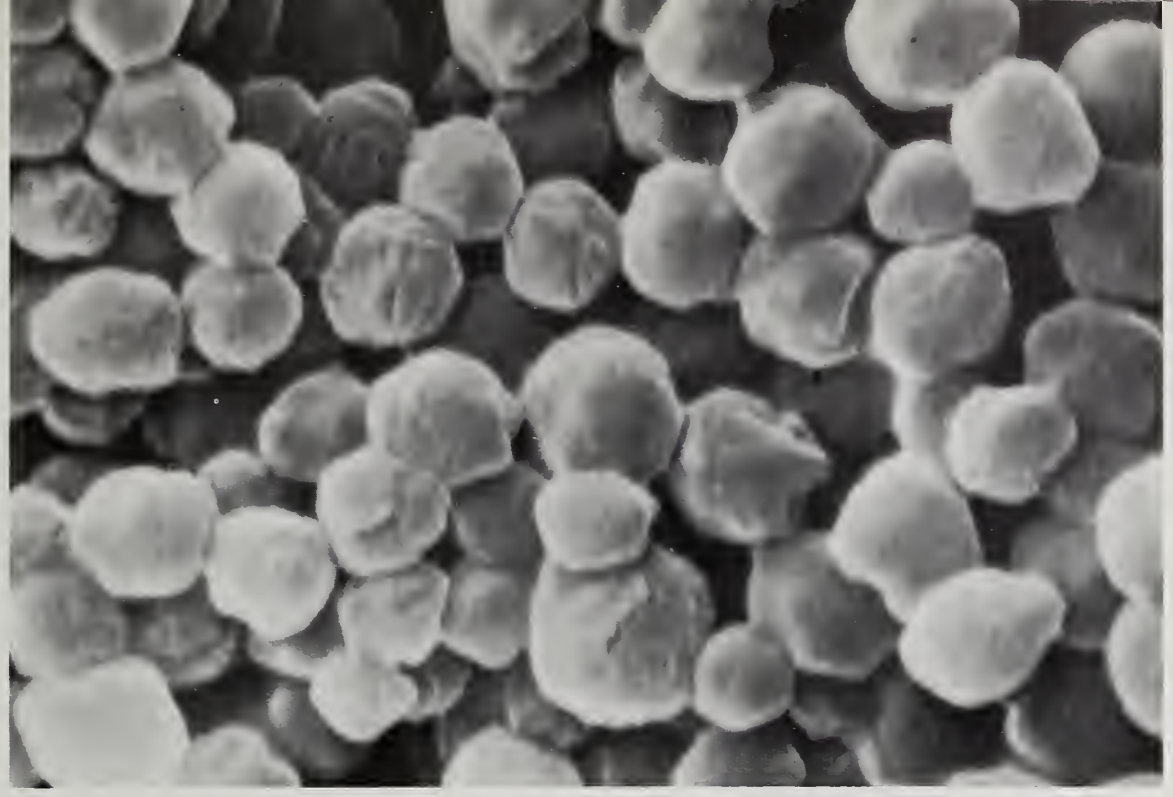
Cascade produces abundant, erect, slender, easily trained shoots. Vines twine closely to the string on the trellis and form an even growth with hops in definite clusters, well distributed over the vines. Cones are compact, medium-sized, pick easily, and adapt to mechanized harvesting.

Cascade yields—about 2,000 pounds of dried hops per acre—compare favorably with the variety Fuggle's industry-wide average yield of 1,165 pounds per acre. Fuggle is the only extensively grown U.S. variety that is considered to be a continental or European aroma and flavor type.

For many years ARS has conducted cooperative research on hop improvement with the State Experiment Stations of Oregon, Washington, Idaho, and California, and the United States Brewers Association. The Cascade hop came about as a result of an ARS team effort involving: plant pathologist Chester E. Horner, plant geneticist Alfred Haunold, chemist Sam T. Likens, Corvallis, Oreg., plant physiologist Charles E. Zimmerman, Prosser, Wash., and agronomist Stanley N. Brooks, Pullman, Wash.

"We anticipate that the major domestic use of Cascade will be by brewers presently using substantial amounts of Fuggle or imported hops in their brewing formula. These brewers should realize considerable savings arising both from higher alpha-acids and lower costs. Cascade may also have good potential for export as hops, or as extract or powder preparations," Dr. Horner said. Alpha-acids impart brew bitterness and flavor.

Future production of Cascade in large quantity, Dr. Horner believes, will depend much upon brewing results from the 1972 crop. □



*Polyhedral-shaped inclusion bodies of* Heliothis *NPV range in diameter from 0.2 to 15 microns. Virons are occluded singly or in bundles in these bodies. Nucleopolyhedrous viruses, which develop in cell nuclei of insects, account for 41 percent of described arthropod viruses (PN–2831).*

# Viruses for 'natural' insect control

MOST PEOPLE associate viruses with plagues. Insect virologists, however, are working on the concept that viruses may be used to benefit man—to biologically control an insect pest.

Some 400 different viruses have been isolated from insects and mites. Among those showing particular promise in lessening dependence upon chemical insecticides is the *Heliothis* nucleopolyhedrosis virus (NPV), now being used against the cotton bollworm or tobacco budworm on cotton.

Natural epidemics which completely wipe out populations of some insects annually attest to the effectiveness of insect viruses. Unfortunately, in such cases, "natural" control often comes after the damage has been done. By spraying plants with a viral insecticide while caterpillars are still young, extensive crop damage could be prevented.

A recent experimental finding that may advance the use of viral insecticides was made by ARS entomologists Carlo M. Ignoffo, Frank D. Parker, Robert E. Pinnell, and Donald L. Hostetter, in cooperation with the Missouri Agricultural Experiment Station, Columbia, and Orlin P. Boening of the International Minerals and Chemical Corporation.

They found that activated charcoal protects *Heliothis* NPV against sunlight when sprays containing the virus are used to control corn earworm.

Normally, one-half of the *Heliothis* NPV, unprotected from sunlight, is inactivated in about 1 day. Addition of activated carbon to the spray application extended the half-life of the virus on sweet corn silks in the field to about 3 days. The spray material, suspended in water, was applied at the rate of 17 gallons per acre. This amount contained 1 pound of carbon and 150 grams of a commercial virus preparation. On cotton foliage, activated carbon extended the half-life to about 5 days.

The corn earworm, also known as tomato fruitworm and bollworm, is a major pest of cotton as well as corn. The *Heliothis* NPV was granted the status of temporary exemption from a requirement of a tolerance for residues in and on cotton seed. This was the first time an exemption was granted for a viral insecticide.

The virus has been fed to many different insects, tested on other invertebrates and vertebrates including man, and repeatedly applied in tests to many different crops without any reported ill effects to users, wildlife, beneficial insects, or plants. It was found to replicate only in species of *Heliothis* larvae. Further study would be needed before the pesticide could be registered for use on corn.

Within the past 10 years, five different viruses have been produced by American and foreign commercial firms and made available for experimental control of insect pests. All are of the nucleopolyhedrosis type, so called because they replicate in the nucleus of infected cells and because they contain virions embedded in a polyhedral-shaped protein matrix or inclusion body. Virions are particles that contain nucleic acid which in turn induces viral diseases.

Viral diseases have been found in all major orders of insects. Some 83 percent of the viruses isolated have come from caterpillars of moths and butterflies, perhaps because many economic pests are in that group.

Caterpillars feed on plants where viruses are present and consequently ingest the viral inclusion bodies, which dissolve in their stomachs. Seconds later, the virions, or infective subunits, are released. These pass through the gut wall of the caterpillar and infect the nuclei of susceptible cells where replication occurs. The virus continues to grow in susceptible cells until the caterpillar eventually dies.

Caterpillars must be reared and infected with the virus to produce the biological insectide, because viruses can only be grown on living systems. Improvement in the production technology is needed for further development of insect viruses into practical, effective, safe, specific, and biodegradable insecticides. □

*Right: Rotating-boom rainfall simulator produces a high-intensity storm on plots located on a sloping feedlot near Omaha, Nebr. Runoff is measured and samples taken over each 6-minute period during the storm for physical and chemical analyses (BN–39866). **Far right:** Agricultural engineer Charles Linderman examines accumulated solids from soil and manure. Most of the solids transported by runoff can be readily settled out and held on the feedlot or in a debris basin (BN–39865). **Below right:** soil scientist Lloyd N. Mielke checks ground water level recorder at an instrumented feedlot site in the Platte River valley near Central City, Nebr. The quality of water here is not affected by the feedlot (BN–39867).*

# Keeping

CONTINUING RESEARCH is showing how and when Great Plains cattle feedlots may contribute to water pollution and is demonstrating that, with adequate control of runoff, feedlots can be acceptable neighbors.

When established principles of soil and water conservation engineering are not followed, feedlot runoff can make a nearby stream or lake unusable for domestic water supply, recreation, or commercial use. In total, though, the contribution of feedlots to water pollution is not great. If every feedlot in Nebraska annually discharged 12 inches of runoff directly into the Missouri River, which it does not, the total would be equivalent to less than 5 hours' flow of the river for 1 day.

ARS agricultural engineers, microbiologists, and soil scientists have cooperated with the Nebraska Agricultural Experiment Station, Lincoln, since 1968 in studies of rainfall, snow, temperature, and evaporation as they affect pollution from sloping feedlots (AGR. RES., Feb. 1971, p. 5).

These studies show that widespread contamination of ground water by infiltration from the feedlot surface is improbable. Once a manure pack is formed on a continuously used feedlot, *infiltration* is insignificant or very slow. In isolated local situations, however, underground sandstone or limestone formations may deliver surface flows directly to ground water.

The research indicates, though, that feedlots should be designed to restrict *surface runoff*, which may transport heavy loads of pollutants.

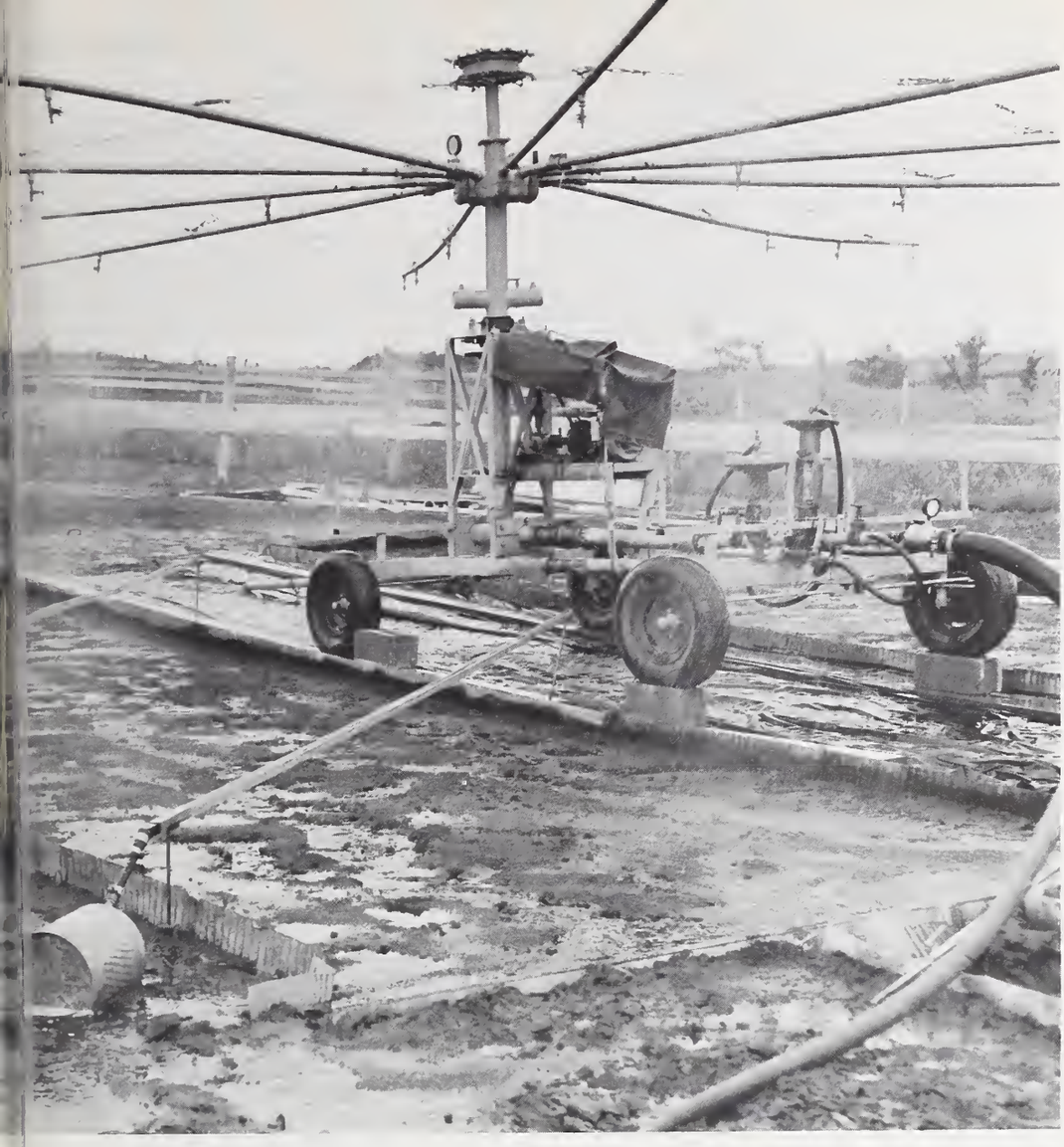
At a feedlot on a 6-percent slope near Gretna, Nebr., precipitation occurred on 244 days in 3½ years, and runoff of more than 0.01 inch was measured on 70 occasions. The studies indicate that runoff may not be expected after smaller than half-inch rains unless rainfall has occurred within the previous 3 days. Because of the water-absorbing capacity of the soil-manure mixture on the feedlot surface, no runoff was produced by rains of nearly 1 inch after summer dry periods.

The estimated runoff from an eastern Nebraska feedlot, about 9 inches a year, is two to three times that from cropland. The relatively impervious surface of the feedlot also allows runoff to start sooner than from adjacent fields.

Nevertheless, the amount of solids—including wastes—transported in runoff may be less from a feedlot than from tilled bare soil. Intensity of rainfall affects the amount of solids carried; a moderate increase in rainfall intensity initiates a higher transport of solids in the same volume of feedlot runoff.

Experiments with a rainfall simulator in an established feedlot on an 8.5-percent slope produced solid losses as high as 10.7 and 27.9 tons per acre-foot when intensities averaged 2.74 and 5.17 inches per hour, respectively. The solids were primarily soil, but the chemical oxygen demand of the animal wastes in the runoff ranged from 529 to 6,750 milligrams per liter. Chemical oxygen demand is a measure of the oxygen required to oxidize all organic compounds and is thus a measure of pollution potential.

Snowmelt runoff may transport up to 10 to 12 times the amount of solids removed in rainfall from the same feedlot, and the chemical oxygen demand



# runoff safe

will thus be correspondingly higher.

An acre-foot of runoff from an eastern Nebraska feedlot may contain 5 to 60 pounds of ammonia-nitrogen, 2 to 23 pounds of nitrate-nitrogen, and about 100 pounds of phosphorus. These amounts are up to 30 times the ammonia, four times the nitrate, and 75 times the phosphorus content of runoff from fallow land.

Precipitation rapidly leaches both forms of nitrogen from the feedlot surface, so amounts in initial runoff decrease with continuing rainfall. Runoff from a second rain several hours later will again have a higher ammonia-nitrogen content but will not contain an increased level of nitrate-nitrogen. Microbial action in the organic matter on the feedlot surface is stimulated by initial precipitation. Phosphorus loss, closely related to solids removal, is directly influenced by rainfall intensity.

The potential pollution hazard from a particular feedlot can be determined only by study of the watershed of which it is a part—its hydrologic characteristics and its proximity to surface water sources. Complete control of runoff may not be required if, for example, the runoff from a 500-animal feedlot is distributed as overland flow over 50 to 100 acres of cropland before joining the runoff from 200 or more acres. In other situations, complete control of feedlot runoff is the only safe course. □

# Compounds attract screwworm fly

SCIENTISTS are developing a synthetic attractant that would allow, for the first time, the direct ecological study of male screwworm flies in nature.

Success of the screwworm eradication program now underway in the southwest and Mexico depends largely upon the competitiveness of plant-produced sterile screwworm males for native virgin females. Lack of a suitable attractant, however, plus low population density of male flies in nature makes direct observation impossible.

Chemist Rolland R. Grabbe, entomologist Gaines W. Eddy, and insect technologists John P. Turner and Francisco C. Gonzalez working at Mission, Tex., have developed an experimental attractant made up of 36 compounds they believe to be degradation products of animal protein.

Liver-baited traps have been used in screwworm studies for more than 40 years, but liver does not attract many male screwworm flies and attracts large numbers of other carcass-breeding insects. It is both time-consuming and costly to pick out the few screwworm flies from the many species trapped.

A preliminary trapping study was conducted over a 3-day period to compare the first generation experimental attractant with aged liver. A total of eight traps were used; four baited with the chemical mixture and four baited with aged liver.

Traps baited with the synthetic attractant netted 246 screwworm flies, 67 of which were male, and 8,302 other insects. Liver-baited traps netted only 10 screwworm flies, all females, and 1,045 other insects. The limited tests, in addition to trapping more screwworm flies than the liver bait, also trapped a smaller percentage of other insects. The synthetic attractant showed a ratio of only 33.7 to 1 while the liver bait showed a ratio of 104.5 to 1.

The traps baited with the chemical mixture not only trapped many more screwworm flies but also trapped a high percentage (27 percent) of males. The average percentage of male screwworms trapped during 2 months with the synthetic attractant was 24 percent, or 741 screwworm flies.

The researchers point out that additional research is needed along three basic lines. Ineffective or undesirable compounds must be eliminated from the chemical mixture, determination of the most effective concentration and practical amounts must be worked out for field use, and means must be developed to improve the lasting effects of the synthetic attractant. □

*Dr. Devine examines alfalfa that has been artificially inoculated with anthracnose. These plants, found to be resistant, will be used in breeding procedures to develop highly resistant commercial varieties (1270X1234–4).*

# Hardy and resistant alfalfas

NEW experimental varieties of alfalfa resistant to anthracnose have outyielded several commercial varieties by at least 1 ton per acre in Maryland field tests. These results indicate a major breakthrough in incorporating disease-resistance in forage crops.

Anthracnose damages more than 4 million acres of alfalfa annually, accounting for losses of several million dollars in potential yields. Added to this loss is the cost of weed control in disease-weakened stands of alfalfa. Such losses could be significantly reduced by use of the resistant varieties. Environmental pollution problems would also be minimized because less herbicide would be needed to control weeds.

Plant geneticist Thomas E. Devine and agronomist Clarence H. Hanson, stationed at the Agricultural Research Center, Beltsville, Md., employed plant-breeding procedures that rapidly built up high resistance to anthracnose. The scientists artificially inoculated tens of thousands of seedlings with anthracnose. They then selected a large number of resistant plants for intercrossing in breeding procedures designed to preserve genetic variation as well as develop high resistance to anthracnose (AGR. RES., Sept. 1971, p. 10). The new experimental varieties were developed from Glacier, Saranac, Team, and Vernal alfalfa.

The experimental varieties had 85 to 95 percent pure stands. In comparison, control plots of six commercial varieties were weakened by disease, and weeds occupied over 50 percent of the plot areas. Stands of susceptible strains were lost in 2 years or less. Stands of resistant strains were still good after 3 years.

The experimental varieties developed by Dr. Devine and Dr. Hanson yielded 7 to 8 tons of alfalfa hay per acre, annually, in field plots in two areas of Maryland. Such yields are excellent for the East, exceeding those of other varieties by a ton or more. Good management practices are partly responsible for the high experimental yields. Resistance to anthracnose, however, played the most critical role, because adjacent comparison plots of the same parent varieties received the same management.

Seven of these experimental alfalfas were released to plant breeders for development of named varieties adapted to local conditions. Seed of varieties developed from the experimental strains may become available to growers within 2 to 4 years.

ARS agronomist Oliver J. Hunt, Reno, Nev., produced seed of the experimental strains for the Maryland tests. John A. Schillinger, plant breeder, and Lenat Hofmann, agronomist, Maryland Agricultural Experiment Station, College Park, cooperated with field evaluation of the resistant strains.

Anthracnose resistance is particularly important in the South and the southern parts of the Middle Atlantic and North Central States. This disease is caused by the fungus *Colletotrichum trifolii,* which attacks the stems and crowns of alfalfa. Depending on the severity of the disease, plants may be killed or debilitated sufficiently to severely reduce their productivity. □

# Testing for pregnant ewes

THE DISCOVERY of a simple, accurate, and rapid technique for pregnancy testing of sheep, promises to save sheepmen millions of dollars annually otherwise wasted on feeding nonpregnant ewes and ewe lambs through most of the winter. Cost of feed frequently exceeds the total value of the ewe, especially if she is old and not pregnant.

Pregnancy testing of cows and heifers has led to great increases in efficiency in the beef cattle industry. The culling of open cows before high-cost winter feeding and the marketing of nonpregnant heifers has not only saved feed but dramatically improved the calf crop and the net return.

Animal physiologist Clarence V. Hulet of the U.S. Sheep Experiment Station, Dubois, Idaho, has developed a method of pregnancy testing of sheep that is nearly 100 percent accurate.

"Early evaluation of the method indicates that when proper handling equipment, including a holding cradle, has been devised, ewes can be pregnancy tested by a technician and three assistants at a rate up to 150 per hour," Dr. Hulet says.

The Dubois method of pregnancy testing uses the holding cradle and a hollow plastic rod with a solid bullet-shaped tip about five-eighths of an inch in diamenter and 20 inches long.

After a sheep has been laid on its back in the cradle, a trained technician gently inserts the rod into the rectum to a depth of about 12 to 14 inches in the posterior abdominal region. The rod—called a palpation rod—is pressed gently but firmly upward and the pregnant uterus can usually be felt to twist and roll when manipulated by the rod. The free hand placed on the abdomen of the sheep just in front of the udder is used to feel and identify the relatively solid form of the fetus. If no fetus is felt after examining from the extreme left to the extreme right of the posterior abdominal cavity, the ewe is not pregnant. The rod can be clearly felt through the abdominal wall in all positions in the nonpregnant ewe. It is that simple.

Dr. Hulet says pregnancy testing can be done 60 to 115 days after breeding but for greater speed and accuracy he suggests 70 to 110 days.

Other added advantages of this method include:

- The discovery that ewe lambs that conceive or even show heat their first winter are more productive the rest of their lives than their contemporaries that fail to lamb or show heat their first winter. There is a genetic component handed down from generation to generation which will increase the percentage of ewe lambs conceiving and give a small but permanent advantage in production each succeeding year. Pregnancy testing provides an efficient way of selecting for these advantages. Nonpregnant ewes can be sold as fat lambs.
- The method shows promise of being relatively accurate in detecting twin-bearing ewes. However, twin-testing requires more skill and training than does the regular pregnancy test.

Plans are underway at the Station to teach the technique to representatives from experiment stations and educational institutions in special short courses. They, in turn, will then be able to teach the technique to students, technicians, and producers.

Other slower but highly accurate methods of pregnancy testing in sheep are the laporotomy method where a small incision is made in front of the udder and the uterus is palpated with a finger. Another is the Ultrasonic Doppler technique. This method is based on sound and listens for the pulse of the lamb placenta. Although both methods have a high accuracy rate, only 20 to 50 ewes can be tested per hour. Also, testing equipment is expensive, and more technical skill and training are required for those methods. □

# Second fire ant species identified

EFFORTS TO CONTROL imported fire ants may advance faster with the discovery that there are not one but two species in the United States. Although introduced about 20 years apart, the two species had been thought for more than 30 years to be forms of a single species, *Solenopsis saevissima richteri.*

Behavioral differences of the two species could influence efforts to control the ants by conventional or alternate methods. Progress in biological control studies would be jeopardized by the chance of studying the wrong species in the wrong habitat, according to entomologist William F. Buren, of the Georgia Center for Disease Control, Atlanta.

The two species originated in widely separate parts of South America: Uruguay and central Brazil—a distance about as great as that between Minneapolis and New Orleans. Dr. Buren determined the existence of the two species with the aid of ant collections made available by ARS entomologists.

Identification of the two species of imported fire ants will affect work by scientists at five State agricultural experiment stations, involving projects funded by ARS. Natural enemies and diseases of the ants, hormones, and sex attractants that might be employed against the ants are under study at the experiment stations. Results of past studies may also need to be reevaluated to determine their relevance to each species of imported fire ant.

Entomologist David R. Smith of the Systematic Entomology Laboratory, Washington, D.C., suggested common names for the two species: red imported fire ant (*S. invicta*) and black imported fire ant (*S. richteri*). The new scientific names were selected by Dr. Buren.

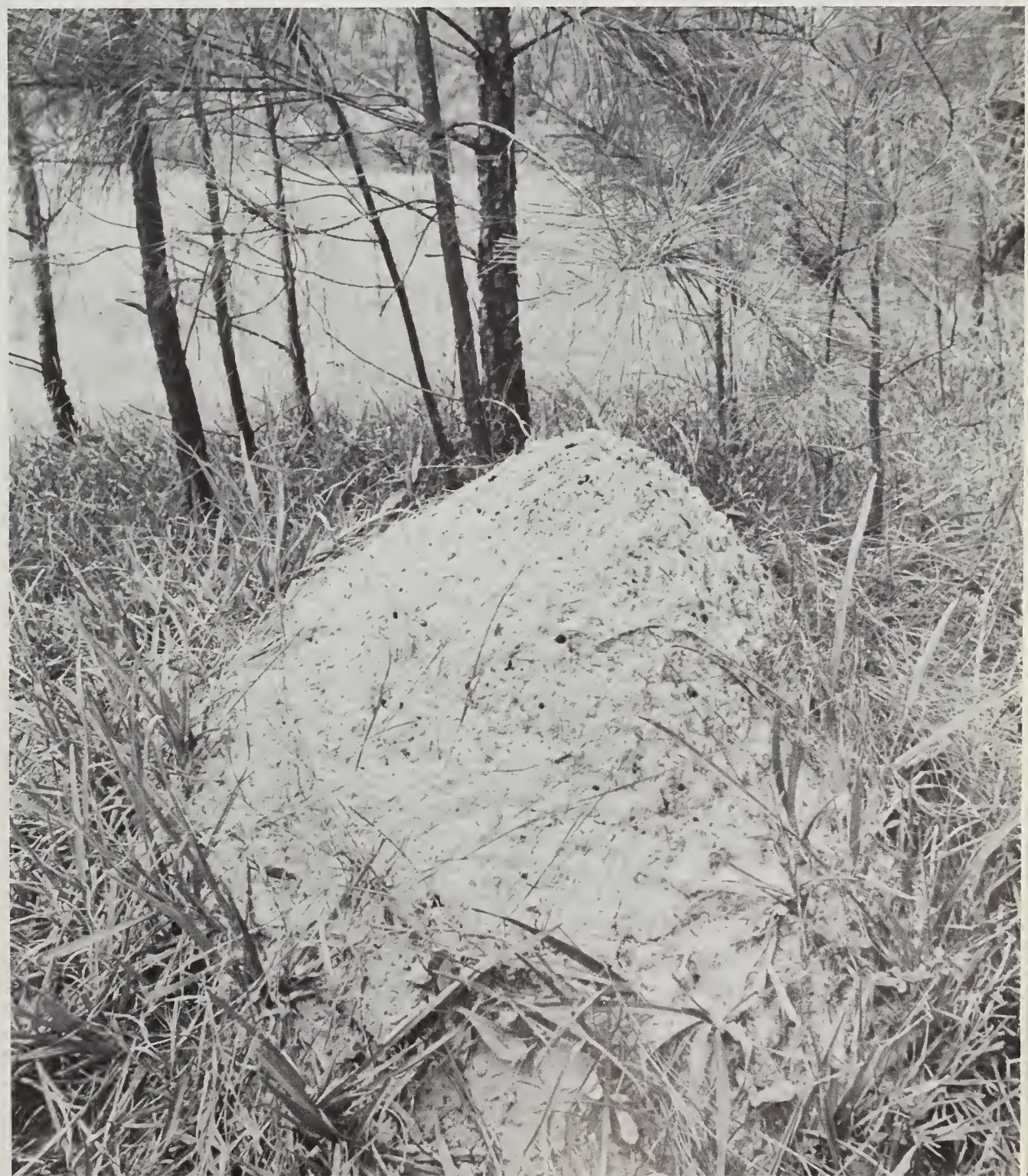
The red imported fire ant began to spread rapidly from Mobile, Ala., in the 1940's, and is now found in nine Southern States. In competition for foraging territory and food, the red species appears more vigorous than the black imported fire ant, except under environmental conditions in parts of northern Alabama and northern Mississippi—the only areas where the black species is now found, although it was first noted in the Mobile area in 1918.

Dr. Buren attributes the red species' rapid spread to the absence of competitive species. A native fire ant, *S. xyloni,* is much less vigorous than the two imported species.

Color and size of the two imported fire ants overlap, requiring an expert's eye to distinguish between them. In Argentina, where the black species is dominant, the ant's nesting mounds are taller and more conical than those of the red imported fire ant. Other biological differences may become evident now that taxonomic separation can be made in classifying the ants, Dr. Buren believes.

The black imported fire ant is also found in Uruguay, and the red imported fire ant is found in Brazil. □

*Fire ant nesting mound in compact soil. Nest may extend 3 feet or more beneath the surface. In addition to their unsightly appearance on lawns, the mounds damage farm implements in fields (0972A1285–29).*



# Food fats from tallow?

COCOA BUTTER has long been a desirable but expensive confectionery fat. An economical substitute may be in the offing: tallow or beef fat, a commodity in abundant supply.

Research chemists Herbert L. Rothbart, Francis E. Luddy, James W. Hampson, and Samuel F. Herb of ARS' Eastern regional research laboratory in Philadelphia used certain solvents, like acetone, to separate the tallow into usable fractions.

At room temperature, these fractions range from a hard solid to a liquid. Between these two extremes lies a plastic solid fraction. The pliability of the plastic can be varied widely by the amount of the other fractions included with it.

The scientists discovered that one of the plastic solid fractions, representing 20 percent of the whole tallow, has promising food uses, particularly in candymaking. Like cocoa butter, it remains solid at room temperature but melts at body temperature. Candy coatings made with such a fat melt in the mouth without leaving a waxy sensation. This tallow fraction is compatible with cocoa butter, so it could be used as an extender with the more expensive fat. An added advantage of using this plastic solid tallow fraction in candymaking is that it shrinks when molded.

Although the plastic solid fraction appears to be the most valuable, Dr. Rothbart and his research team are also considering uses for the hard solid (15 percent) and the liquid (65 percent) fractions.

The liquid fraction has properties that suggest usefulness as a cooking or salad oil. The scientists are also experimenting with a blending of the hard solid and liquid fractions to make plastic shortenings or margarine-like products. They say the hard solid fraction could even be blended with another oil.

By blending the fractions, it should be possible to construct fats that would have the specific physicochemical properties required for speciality food uses. Such flexibility, common with synthetic products, has heretofore been unattainable with most natural products like beef fat.

Tallow fractionation is performed readily in the laboratory, and the ARS scientists believe it could be carried out economically on a large scale.

Commercial operation of the tallow separation process could have an enormous effect on the livestock industry. More tallow might go into edible markets where it would bring a much higher price. Practically all of the 5 to 6 billion pounds of beef fat produced annually in the United States is potentially edible. Today's edible markets, however, are small, mainly for shortenings and spreads. Thus about nine-tenths of the tallow produced is diverted to "inedible" markets, about half of which is exported.

Of course, if the plastic solid fraction were to gain acceptance as a cocoa butter substitute or extender, it should bring a higher price than today's edible tallow.

The next step is to improve the tallow-fractionation process and to demonstrate its commercial feasibility. In the meantime, products like the plastic solid fraction and other possible fraction combinations are being evaluated for further uses. □

# AGRISEARCH NOTES

## Monkeys and Marek's disease

INOCULATION of monkeys with Marek's disease virus (MDV) and herpesvirus of turkeys (HVT), apparently failed to produce clinical signs of disease.

ARS scientists at East Lansing, Mich., in cooperation with researchers at Rush-Presbyterian St. Lukes Hospital and University of Illinois Medical Center, Chicago, performed the experiments in part to determine if the two viruses have any harmful effects on animals other than poultry, including man.

Marek's disease virus, a herpesvirus, is known to produce tumors in chickens. Mere infection of chickens with the virus does not cause the disease, however. Epidemiological studies have shown MDV is widespread among commercial flocks. Widespread vaccination for Marek's disease with the nonpathogenic HVT, which cross-reacts with MDV, has resulted in many dually infected chickens. For this reason, it seemed especially important to investigate possible public health hazards of these viruses.

In the experiment, blood tests and liver biopsies of monkeys showed no abnormalities. Four groups of experimental marmoset monkeys observed for a year or longer showed no symptoms of disease attributable to virus inoculations. Observations are continuing.

Serum from one of 34 monkeys inoculated with HVT and two of 29 inoculated with MDV tested positive for HVT and MDV antibodies in immunofluorescent tests, but two of the three tested positive before inoculation. The most likely explanation for existence of preinoculation antibodies is that the monkeys may have been infected with another antigen related to HVT. The specificity of these antibodies could not be determined.

Attempts to reproduce MDV and HVT in cell cultures of marmoset kidney, skin, and muscle and in human embryonic kidney cells were unsuccessful.

Observations on the relative resistance of mammals to avian herpesviruses are reinforced by additional studies in progress with rhesus and synomolgus monkeys.

## Allelochemics affect growth

PLANT COMPOUNDS known as "allelochemics"—many found in forage crops—can influence growth of other plants and animal organisms.

ARS agronomists Robert F. Barnes and David L. Gustine, of the U.S. Regional Pasture Research Laboratory, University Park, Pa., found that allelochemics can be released by exudation from plant roots, leaching from leaves, volatilization into the air, mastication by animals, and mechanical breakdown of plant tissue.

Some of these substances can be phototoxins that can prevent or inhibit germination of other plant species. Those from wheat and oats, for example, inhibit growth of some weeds, while those from the weed quackgrass inhibit growth of corn. Moreover, production of certain types of allelochemics that tend to be inhibiting can also confer resistance to certain plant diseases and insects.

Drs. Barnes and Gustine also said that some allelochemics can adversely affect livestock production—for example, alkaloids in reed canarygrass, saponins in alfalfa, tannins in lespedeza, coumarin in sweetclover, and the not clearly understood constituents in crownvetch that make it harmful to nonruminant animals.

## Insects avoid prickly wheat

PREVIOUS field and laboratory tests have given rise to the suspicion that some insects do not like to lay eggs in prickly places.

ARS and Indiana researchers have confirmed this suspicion in field-scale tests with the cereal leaf beetle, a serious

insect pest for midwestern wheat growers.

The field plots included four wheats: Arthur, a widely grown variety with a relatively smooth leaf surface, and three new breeding lines with more than twice as much pubescence or hairiness as the Arthur variety.

All three pubescent wheats showed effective resistance against the beetle. The researchers, entomologist Robert L. Gallun and agronomist John J. Roberts of ARS, and research associate Robert E. Finney, and agronomist Fred L. Patterson of the Purdue University Agricultural Experiment Station, Lafayette, report the most effective was PU 66294. It was almost immune to egg laying by the cereal leaf beetle and to subsequent feeding by the larvæ.

Counts taken of eggs per 100 feet of row in the test plots showed 2,213 eggs per 100 feet for the Arthur variety, and only three eggs per 100 feet for the PU 66294 breeding line. The difference in count of infested leaves per 100 feet of row was equally great, 2,435 for Arthur and 19 for PU 66294.

Seed for PU 66294 is being increased for further evaluation and breeding work. The goal of the project is development of a commercial variety resistant enough to the cereal leaf beetle to eliminate the need for insecticide treatments.

## Computers update livestock auctions

USE OF COMPUTERS to process sales data at livestock auction markets substantially improves efficiency of the operation.

Until recently, a clerical staff manually prepared the records, accounts, and checks at each of the Nation's 1,700 livestock auction markets. Excessive labor costs were common and errors were costly.

To solve these problems, ARS scientists working with scientists at the University of Missouri, Columbia, developed a computer system to handle sales data. The system has been used successfully for about 3 years at a livestock auction market in Missouri.

Cooperating on the project were the team of ARS economist Tarvin F. Webb, Beltsville, Md., ARS engineer Herman F. Mayes, Columbia, Mo., and computer scientists Roy F. Keller and Leon F. Johnson, University of Missouri.

The main advantages of the system are that it minimizes the possibility of errors in computations and preparation of records and accounts, speeds up payment for animals following their sale, provides permanent records of all business transacted, and handles all routine accounting tasks such as payrolls.

Adoption of the system by livestock auctions can reduce clerical costs by 50 percent.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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